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# Clustering and Innovation Concepts and Innovative Clusters: An Application on Technoparks in Turkey

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## Abstract

The aim of this paper, clustering, which is an important model in the development of the countries and the concept of innovation have been reviewed together. The most prominent feature of the industry is to produce Technology. Countries to focus on knowledge-intensive industries and businesses as a result of regional cluster policies for innovation is seen that there is a relation between. The samples obtained over the world and have tried to propose solutions for Turkey. Clustering is an important model for an innovational development In Turkey.

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**Keywords:** Clusters, Innovation, Innovative Clusters. Techoparks

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## 1. Introduction

Considering definitions for the concepts of cluster and clustering which were put forward by various scholars, one could see that the clusters are generally focused on in terms of geographical proximity, concentration and networks. The origins of such concepts dates back to Alfred Marshall's studies on industrial regions in 1920s. Following Marshall's work, these concepts again came into prominence in 1970s with the emerging industrial regions in North-eastern Italy.

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It was Michael E. Porter whom brought the concept “clustering” in its prominent status in literature. Today, Silicon Valley in the United States, Automotive Clustering in Germany and Leather Clustering in Italy are the most renowned examples of regional clustering throughout world. However, owing to the recent technological developments and emerging higher ratios of added value as a result of this, nations are stimulated to build technocities which can be defined as information-clusters. Leading examples of this kind of clusters –which produce the highest level of added value- include Silicon Valley, Finland Information Cluster and South Korean Information Cluster.

UNESCO (United Nations Education Scientific Cultural Organization) study suggests that there are 400 internationally-accepted technocities throughout world. According to this study, the USA ranks the first by having more than 150 internationally-accepted technocities, while Japan ranking as the second by having 111 and China the third by having roughly a hundred. As to Turkey, she has only one technocity, namely ODTU Technocity ([www.unesco.org](http://www.unesco.org)). It is known that most internationally-accepted technology-based businesses operate through such technocities. In light of this, one could argue that technocities are important for local businesses in terms of gaining competitive advantage. In this study, innovativeness perceptions of technocities-widely known as innovative clusters- are investigated.

## 2. Literature Review And Hypotheses

As it is not possible to explain the concept of cluster by simply focusing on a single aspect of them, when speaking of clusters one should also take the other aspects of the concept cluster –such as employment of qualified staff, perception of success in comparison with other clustered competitors, desire for strategic cooperation and knowledge (or information) share-, as well as the other aspects of concept innovation like perception of innovation.

### 2.1. *Concepts of Cluster and Clustering and Innovation*

Clustering approach, which reached its climax by works of Michael E. Porter, not only has attracted much attention theoretically but also adopted by many policy-makers in the last two decades. As a result of this worldwide popularity, clustering approach found its repercussions in Turkey, too. For instance, the Ninth Development Plan underlines the importance of promoting clusters in Turkey. In addition, the New Incentive System which came into effect in 2009 aimed to promote sectoral clustering (Keskin & Dulupçu, 2010).

Through process of clustering universities, companies, research centers and policy-makers should cooperate through a common aim which can be defined as achieving a regional or national competitive advantage. As adopting a common objective stimulates non-clustered firms to participate in a cluster and serves for creating new clusters on one hand, it also increases competition among clusters on the other.

At least four suggestions can be made regarding how a cluster can be defined or analyzed; (Anders & Anders, 2007);

- Similar or related economic activities must be concentrated at a specific point spatially.
- These activities must be functionally related to each other via various relations, interactions and transactions.
- A cognition of self-awareness must be built in cluster. Clustered firms must identify themselves as “cluster members” and some kind of coordination mechanism must be set up through the cluster.
- Firms and the cluster, as a whole integrated body, must achieve a very high level of innovative performance.

Filiz Alsaç, by using a table, summarizes a variety of cluster and clustering definitions made by some scholars whom contributed to the literature as follows; (Alsaç, 2010)

Crouch et al. (2001,) “In general terms, clustering can be defined as locating firms in similar sectors geographically close to each other without any kind of political or legal etc. obligation”

Rosenfeld (1997,) “In broadest sense, clustering can be defined as concentration of firms which have the potential of creating synergy via their geographical proximity and interdependency, though they have a lower level of employment”

Feser (1998,) “Economic clusters are not industries and organizations just supporting each other. Instead, via their relations, there is both a competition and reinforcement among them”

Swann and Prevezer (1996,) “Clusters are groups of firms in a specific industry located in a specific geographical space”

Swann (1998,) “Cluster is a group of large firms operating in a specific industry and located in a specific region”

Simmie and Sennett (1999,) “Innovative cluster can be defined as a number of industrial and service companies that operate under same market conditions and have mutual relations and higher cooperation levels, generally as a result of supply chain.”

Roelandt and den Hertog (1999,) “Clusters can be defined as the network of manufacturers and highly interdependent firms (including specialized suppliers) in an environment of production chain producing added-value”

Van den Berg, Braun and van Winden (2001,) “As a popular term, cluster is about local and regional Networks at its best”

Enright (1996,) “A regional cluster is an industrial cluster in which its members are located close to each other”

Peter Drucker defines innovation as a function of entrepreneurship. To him, innovation is to create welfare while using new resources or increasing potential of current ones (Drucker, 1998). According to Van de Ven, “innovation is an idea that can be a combination of older ideas, a scheme or a formula that can change the current structure of an organization or an approach which is perceived as new by individuals” (Van de Ven, 1986). Clusters inclined to make sustainable innovation in their goods and services systems and processes, as well as in their management systems and processes, are called as “innovative clusters”.

According to Harrison (1994) and Porter (1990), as a result of at least two reasons, intra-cluster firms are expected to be more innovative than non-cluster firms. First, intra-cluster firms take advantage of economies of agglomeration such as close suppliers obtaining efficient scales (Scott, 1982), direct monitoring of rivals (Burt, 1987; Harrison et al., 1996) and collective knowledge (Dosi, 1988; Marshall, 1920) Second, intra-cluster firms also exploit network-based effects (Bell, 2005).

It is generally accepted that the main driving factor for firms to enter into clusters is the need for qualified employees. Thus, the most important advantage offered by clusters is to meet the demand of firms for such a qualified labor force. For this reason, most firms tend to prefer clusters in which the qualified labor force readily established, instead of seeking for specialized labor force. Easy access to specialized labor force and again using this labor force for employee substitution create an important advantage for firms. For firms, this kind of advantage is offered by clusters. This alone can form the basis for firms entering into clusters. As emphasized by leading figures of cluster literature like Marshall and Porter, meeting the demand for qualified labor force establishes the ground for clustering argument.

There are a number of factors which underlie the innovative success of industrial clusters; positive economic externalities –in the form of knowledge spillovers based on spatial proximity- and cooperative learning processes being the most prominent ones. These two factors also bring with them specialization and inter-firm cooperation. Spatial proximity, by creating a division of labor in manufacturing of several components, leads to opportunities of specialization to emerge for especially small sized enterprises. As a result of this kind of specialization in manufacturing, every clustered firm becomes more dependent on each other while the exchange of information/labor force between them increases (Brioschi, 2000).

In light of this, our hypotheses are as follows:

H1: The employment rate of qualified employees of clustered firms affects their levels of perception of innovation.

H2: Desire of clustered firms for making strategic cooperation affects their levels of perception of innovation.

H3: Desire of clustered firms for information sharing affects their levels of perception of innovation.

H4: Perceptions of success of clustered firms in comparison with their competitors affect their levels of perception of innovation. The hypotheses and research framework are depicted in Figure 1.

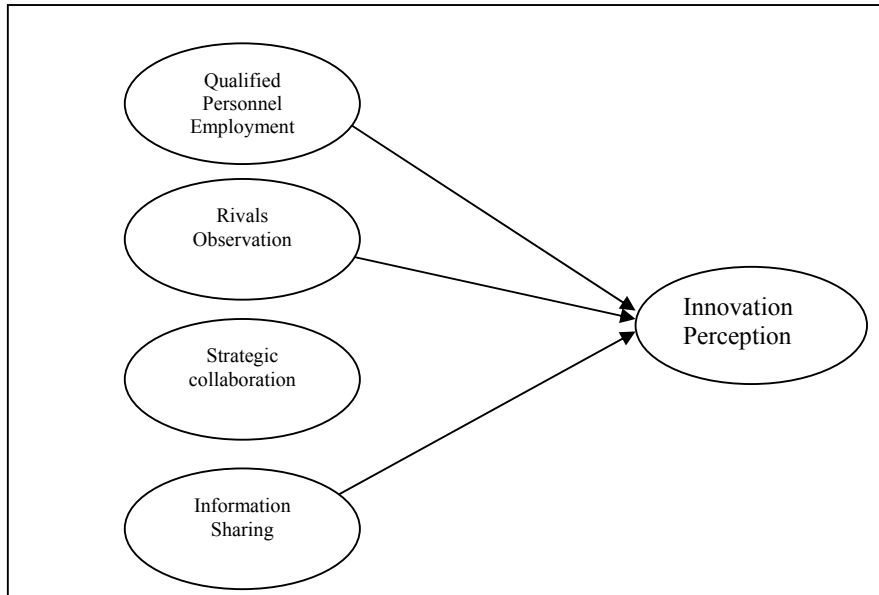


Figure 1. Hypothesized relationships between clustering and innovation

### 3. Methodology

#### 3.1. Research Goal

The aim of this study is to investigate the relationship between perceptions of clusters and innovation for firms operating through technocities that are accepted as innovative clusters. To test the propositions, a field survey using questionnaires was conducted.

#### 3.2. Sample and Data Collection

Searching the cluster and innovation literature, one could easily observe that industry, business and business units are used as the analysis unit and the evaluation is made in terms of innovation introduced by these units (Koçak & Karaca, 2013). Similar to this approach, and in terms of aims of this study, firms operating through technocities are determined as analysis units. Sample for this study consists of 1451 companies operating through 36 technocities in Turkey ([www.konyateknokent.com.tr](http://www.konyateknokent.com.tr)). Data obtained from those 407 questionnaires were analyzed through the SPSS 20.0 for Windows and AMOS 21 statistical packet programs three proposed relations were tested through regression analyses.

### 3.3. Analyses and Results

In study, survey and research methods are based on quantitative data. As the data collection tool, a questionnaire is used. This questionnaire consists of three parts. The first part comprises of closed-ended questions such as gender, age, educational level, Professional position, tenure, technocity in which the firm operates, sector in which the firm operates and founding year of the firm.

The second part comprises of a 9-point scale – measuring intra-technocity firms' perceptions of innovative qualified staff- which was adapted from doctoral dissertations of Poppy Ismalina ("An Integrated Analysis of Socioeconomic Structures and Actors in Indonesian Industrial Clusters") and Irena Vucic ("Cooperation And Cluster Strategies Within And Between Technology- Intensive Organizations: How To Enhance Linkages Among Firms In The Techno-Parks"). The points in this scale are based on Likert's 5-Point Scale in which 1 refers to "strongly disagree" and 5 refers to "strongly agree". The scale which consists of 8 points regarding "Observation of Competitors in Cluster" and originally developed by Camello-Ordaz and others was adapted from Elif Türkan Aslan's doctoral dissertation (Arslan 2012).

The third part consists of scales regarding innovation and its some aspects. A scale which consists of 4 points regarding "innovation perception" and originally developed by Vila and Kuster (2007) is used. This scale was adapted from Durdu Mehmet Biçkes's doctoral dissertation" (Biçkes, 2011).

$$n = \frac{NPQZ^2}{(N-1)d^2 + PQZ^2} \quad (1)$$

Formula of sample size is used and value at equation (2) is computed. This value refers to minimum sample size;

$$n = \frac{1451(0,5)(0,5)(1,96)^2}{(1451-1)(0,05)^2 + (0,5)(0,5)(1,96)^2} \cong 304 \quad (2)$$

407 of questionnaires which are not deficient and erroneous were included in the research. ODTÜ Technocity, with 115 firms (% 28.26), ranked the first in terms of participation. It was followed by Gazi Technopark with 41 firms (% 10.07), ITU Ari Technocity with 34 firms (% 8.35), İzmir Technopark with 33 firms (% 8.11) and Ankara University Technocity with 31 firms (% 7.62) respectively.

### 4. Findings

%37,1 of participants (n=151) were female and the rest %62,9 was male (n=256). In addition, % 4,4 of participants were between ages of 18-25 (n=18), % 25,1 between 26-30 (n=102), % 28,7 between 31-35 (n=117), % 20,6 between 36-40 (n=84), % 12 between 41-45 (n=49), % 4,9 between 45-50 (n=20) and finally % 4,2 was above 50 (n=17). Most of the participants were undergraduates and graduates. Only %1 of them was high-school graduate (n=4), %3,7 of them had associate degrees (n=15), %49,4 of them was undergraduate (n=201) and % 45,9 was graduate (n=187).

In terms of tenure of participants, % 32,4 of them were working in their current firm between 1-3 years (n=132), % 34,4 between 3-5 years (n=140), % 15,7 between 5-7 years (n=64), % 7,9 between 7-9 years (n=32) and finally % 9,6 (n= 39) more than 10 years.

#### 4.1. Reliability and Validity

As can be seen in Table 1, validity and reliability tests of all factors were performed, and Cronbach Alpha values for all factors were found to be very meaningful.

Table 1. Reliability and validity analysis

Constructs	Items	Standardized loadings	Cronbach's $\alpha$
Qualified Personnel Employment	QPE1	0,79	0,93
	QPE2	0,79	
	QPE3	0,84	
	QPE4	0,67	
	QPE5	0,84	
	QPE6	0,83	
	QPE7	0,73	
	QPE8	0,83	
	QPE9	0,80	
Rivals Observation	RO1	0,78	0,92
	RO2	0,80	
	RO3	0,82	
	RO4	0,78	
	RO5	0,81	
	RO6	0,80	
	RO7	0,79	
	RO8	0,73	
Strategic collaboration	SC2	0,80	0,74
	SC3	0,70	
	SC4	0,76	
	SC5	0,51	
Information Sharing	IS2	0,49	0,84
	IS3	0,82	
	IS4	0,81	
	IS5	0,81	
	IS6	0,81	
Innovation Perception	IP1	0,80	0,89
	IP2	0,73	
	IP3	0,78	
	IP4	0,81	

#### 4.2. Inter-construct correlations

As can be seen in Table 2, the highest correlation was found to be between rivals observation and innovation perception ( $r=659$ ,  $p<0,01$ ). On the contrary, the lowest correlations was between strategic collaboration and innovation perception ( $r= 150$ ,  $p<0,01$ )

Table 2. Inter-construct correlations

Constructs	Mean	Std.Dev.	1	2	3	4	5
1.Qualified Personnel Employment	3,48	0,972	1,000				
2.Rivals Observation	3,65	0,862	,414**	1,000			
3.Strategic collaboration	3,90	0,861	,267**	,278**	1,000		
4. Information Sharing	4,18	0,767	,314**	,369**	,541**	1,000	
5. Innovation Perception	3,91	0,840	,326**	,659**	,150**	,352**	1,000

Notes: \*\*Correlation is significant at the 0.01 level (two-tailed).

#### 4.3. Analyses of Model

As can be seen in Table 3, goodness of fitness indices of research methodology were found to be acceptable

Table 3. Goodness-of-fit indices for research model

	$\chi^2$	df	$\chi^2/df$	CFI	GFI	NFI	RMSEA	PNFI	AGFI
Recommended values	n/a	n/a	< 3.0	> 0.9	> 0.9	> 0.9	< 0.08	> 0.5	> 0.9
Model values	884.04	388	2,27	0,98	0,87	0,96	0,056	0,86	0,85

As shown in Figure 1, variable of Rivals Observation affects the innovation perceptions of technocity firms ( $\beta=0,707$   $p<0,05$ ). The second variable affecting firms' innovation perceptions is found to be the Information sharing ( $\beta=0,197$ ,  $p<0,05$ ). Variable of Qualified Personnel Employment (QPE) is found to have the least effect on firms' innovation perceptions ( $\beta=0,570$ ,  $p<0,05$ ). Variable of Strategic Collaboration (SC) is found to negatively affect firms' innovation perceptions ( $\beta=-0,23$ ,  $p<0,05$ ).

In light of this, Hypothesis 1 (The employment rate of qualified staff of clustered firms affects their levels of perception of innovation) is rejected, while the other ones (H2, H3, H4) are accepted

Table 4. Relationship with innovation perception

	Path	Estimate	SE	CR	p
<b>H1</b>	Qualified Personnel Employment → Innovation Perception	0,570	0,034	2,103	,035
<b>H2</b>	Rivals Observation → Innovation Perception	0,707	0,063	11,232	***
<b>H3</b>	Strategic collaboration → Innovation Perception	-0,255	0,077	-3,428	***
<b>H4</b>	Information Sharing → Innovation Perception	0,197	0,053	3,713	***

Notes: \*\*\* $p<0.05$

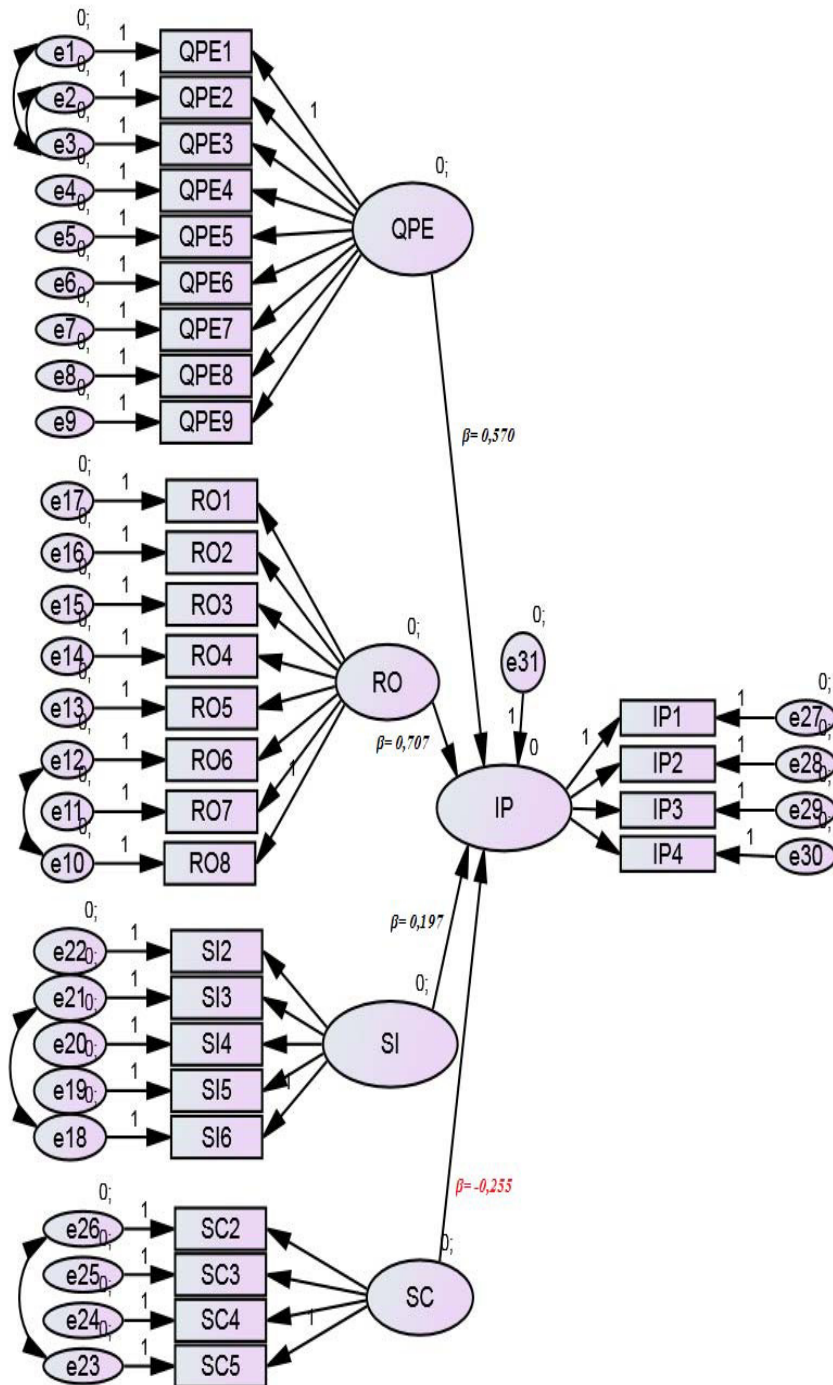


Fig. 2. Research model and AMOS analyze estimates



## 5. Conclusion

Recently, clusters have attracted much attention in both professional and business circles of Turkey. As a factor affecting enterprises' performance positively, the clusters encourage firms to deal with business tasks which otherwise they are not able to accomplish on their own capabilities. Thanks to clusters, firms can develop an awareness of cooperation and tend to adopt win-win strategies. In addition, these kind of strategies can also concern and include the related industrial organizations and research-and-development institutions like universities. Turkey, nowadays, is in a transition period in terms of innovation. One could attribute Turkey's recent breakthroughs in Informatique, National Defense and Health System to its focus on innovation. Firms, in order to survive and grow, should innovate on a regular basis. According to research findings, it is suggested that firms operating through technocities are more inclined to make innovations than their non-clustered competitors.

The lack of a relation between perception of employment of qualified staff and innovation perception is a direct result of intra-technocity firms' failure in harmonizing qualified staff employment with innovation perception. As a result of factor analysis regarding qualified staff employment, it is found that the statement "employees working in a technocity have higher perceptions of innovation" has the highest score. However, no meaningful relation can be found between factors of qualified staff and innovation perception.

The most challenging question that a cluster faces with is the desire of making strategic cooperation. That's because the firms, naturally, tend to be reluctant in terms of opening their own resources to the use of their competitors. However, one of the most important output of a cluster is the extent that it allows clustered firms to make strategic cooperation with each other. Firms' tendency in terms of not sharing their resources -especially their qualified employees- with others is an excusable situation.

By making strategic cooperation, firms can reduce their operational risks and increase the opportunities of growth. The strategy of cooperation can form the basis of innovative opportunities. Owing to cooperation, technocity firms can create a balance between sustaining their future flexibility –by using innovation opportunities which emerged as a result of information gathered from business networks- and protecting sources of their current competitive advantages against financial and commercial shocks. Furthermore, strategic cooperation (or alliances) creates learning opportunities between firms. This kind of emerging learning processes can be strategically used not only for creating opportunities for innovation and growth, but also for reducing the risks of sustainability.

Source of firms' competitive advantage is not the information itself, but its share among the firms. Share of information activates the saturation level of firms, thus this information can easily be conveyed to other firms while creating positive economic externalities stemming from itself. Meaningful relation between firms' desire to share information and their capacity to employ qualified staff can be translated as qualified staff is needed in order to ensure information share and knowledge spillover, and thanks to these qualified employees innovative products and services can be manufactured. Marc D. Bahlmann and Marleen H. Huysman (2008), in their study ( "The Emergence of a Knowledge-Based View of Clusters and Its Implications for Cluster Governance") argue that for knowledge spillovers to be ensured there is a need for specialized labor force and that this labor force, by imitating each other, can produce innovative products and services.

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